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Optimization of microwave sol–gel synthesis of N-Ce-AC/TiO_2 for adsorption/photodegradation of tetracycline

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ABSTRACT

Nitrogen (N) and cerium (Ce) co-doped titanium dioxide (TiO_2) supported activated carbon (AC) (N-Ce-AC/TiO_2) were synthesized to remove antibiotic tetracycline from aqueous solution via adsorption and photodegradation. The sol–gel technique, aided by microwave radiation, was used to synthesize N-Ce-AC/TiO_2. Central composite design under response surface methodology was used to optimize the variables comprising urea (N source) (*A*: 0.02–0.20 g), cerium(III) nitrate hexahydrate (Ce source) (*B*: 0.02–0.20 g), activated carbon (*C*: 0.10–0.50 g), and microwave power (*D*: 600–800 W), where the degradation of tetracycline was the response. Characterization of the produced catalyst was carried out by means of X-ray diffraction, scanning electron microscopy, energy-dispersive X-ray spectroscopy, and the Brunauer–Emmett–Teller method for determining surface-texture parameters. N-Ce-AC/TiO_2 prepared with 0.50 g activated carbon, doped with 0.02 g urea and 0.20 g cerium, and activated at microwave power 600 W for 15 min exhibited 91.08% tetracycline removal when subjected to 7 W of UV irradiation, according to the results of optimal variable preparation.

Keywords: Activated carbon; Adsorption; Microwave radiation; Photodegradation

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